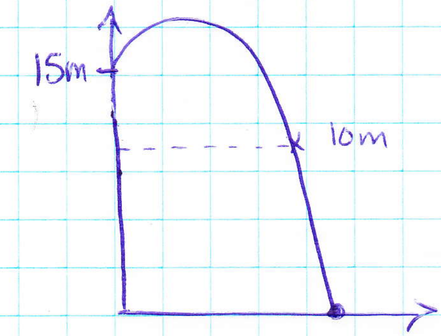
p 357

#2 $h = -5t^2 + 22t + 15$



a) $t = 0$

$h = -5(0)^2 + 22(0) + 15$
$h = +15$

$\therefore$ the height of the school is 15m

b) $10 = -5t^2 + 22t + 15$
$0 = -5t^2 + 22t + 15 - 10$
$0 = -5t^2 + 22t + 5$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{-(22) \pm \sqrt{(22)^2 - 4(-5)(5)}}{2(-5)}$$

$$= \frac{-22 \pm \sqrt{584}}{-10}$$

$x_1 = \frac{-22 + \sqrt{584}}{-10}$ $\quad$ $x_2 = \frac{-22 - \sqrt{584}}{-10}$

$\boxed{x_1 \doteq -0.22}$ Reject $\quad$ $\boxed{x_2 = 4.62}$

$\therefore$ at 4.62 seconds the rocket will be 10m above the ground.

c) $h = -5t^2 + 22t + 15$
a b c

$$x = \frac{-(22) \pm \sqrt{(22)^2 - 4(-5)(15)}}{2(-5)}$$

$$x = \frac{-22 \pm \sqrt{784}}{-10}$$

$x_1 = \frac{-22 + \sqrt{784}}{-10}$ $\quad$ $x_2 = \frac{-22 - \sqrt{784}}{-10}$

$\boxed{x_1 = -0.6}$ $\quad$ $x_2 = 5$
Reject

$\therefore$ the rocket hits the ground at 5 seconds

d) $h = -5t^2 + 22t + 15$
$= -5(t^2 - 4.4t) + 15$
$= -5(t^2 - 4.4t + 4.84 - 4.84) + 15$
$= -5[(t - 2.2)^2 - 4.84] + 15$

$= -5(t - 2.2)^2 + 24.2 + 15$

$= -5(t - 2.2)^2 + 39.2$

$\therefore$ the maximum height of the rocket is 39.2m.

or

$x = \frac{-b}{2a}$
$= \frac{-22}{2(-5)}$
$= 2.2$

sub $x = 2.2$
$y = -5(2.2)^2 + 22(2.2) + 15$
$= 39.2$

3. a) $H = -0.011x^2 + 0.99x + 1.6$

$= -0.011(x^2 - 90x) + 1.6$

$= -0.011(\underline{x^2 - 90x + 2025} - 2025) + 1.6$

$= -0.011[(x-45)^2 - 2025] + 1.6$

$= -0.011(x-45)^2 + 22.275 + 1.6$

$= -0.011(x-45)^2 + 23.875$

$\therefore$ the maximum height is 23.88m

b) $15 = -0.011x^2 + 0.99x + 1.6$

$0 = -0.011x^2 + 0.99x + 1.6 - 15$

$0 = -0.011x^2 + 0.99x - 13.4$

$\quad\quad a \quad\quad\quad b \quad\quad\quad c$

$x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$= \dfrac{-(0.99) \pm \sqrt{(0.99)^2 - 4(-0.011)(-13.4)}}{2(-0.011)}$

$= \dfrac{-0.99 \pm \sqrt{0.3905}}{-0.022}$

$x_1 = \dfrac{-0.99 + \sqrt{0.3905}}{-0.022}$ $\quad\quad$ $x_2 = \dfrac{-0.99 - \sqrt{0.3905}}{-0.022}$

$x_1 \doteq 16.6$ $\quad\quad$ $x_2 \doteq 73.4$

$\therefore$ the firefighter could stand 16.6m & 73.4m back.

5 $y = a(x-28)^2 + 1024$

$(10, \underline{\underline{-4160}})$ sub in to solve $\underline{\underline{a}}$

negative loss

$-4160 = a(10-28)^2 + 1024$

$-4160 - 1024 = a(-18)^2$

$\frac{-5184}{+324} = \frac{+324a}{+324}$

$a = -16$

$$\boxed{y = -16(x-28)^2 + 1024}$$

Breaks even = $\underline{\underline{\text{Zeroes}}}$

$y = -16(x-28)(x-28) + 1024$

$= -16(x^2 - 56x + 784) + 1024$

$= -16x^2 + 896x - 12544 + 1024$

$= -16x^2 + 896x - 11520$

a b c

$$x = \frac{-(+896) \pm \sqrt{(+896)^2 - 4(-16)(-11520)}}{2(-16)}$$

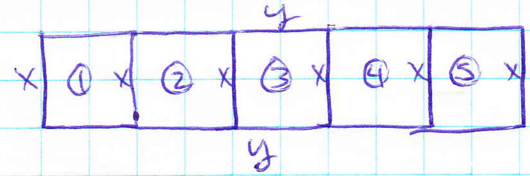
$$= \frac{-896 \pm \sqrt{65536}}{-32}$$

$x_1 = \frac{-896 + \sqrt{65536}}{-32}$ $x_2 = \frac{-896 - \sqrt{65536}}{-32}$

$x_1 = 20$ $x_2 = 36$

$\therefore$ she breaks even at \$20 or \$36.

7.



① $A = xy$ (Area)

② $30 = 6x + 2y$ (Perimeter)

isolate y in ②

$$2y + 6x = 30$$

$$\frac{2y}{2} = \frac{30}{2} - \frac{6x}{2}$$

$$\boxed{y = 15 - 3x}$$

sub $y = 15 - 3x$ into ①

$$\begin{aligned} A &= xy \\ &= x(15 - 3x) \\ &= 15x - 3x^2 \\ &= -3x^2 + 15x \\ &= -3(x^2 + 5x) \\ &= -3(x^2 + 5x + 6.25 - 6.25) \\ &= -3[(x + 2.5)^2 - 6.25] \\ &= -3(x + 2.5)^2 + 18.75 \end{aligned}$$

Solve for y

$$\begin{aligned} 2y + 6x &= 30 \\ 2y + 6(2.5) &= 30 \\ 2y + 15 &= 30 \\ 2y &= 30 - 15 \\ \frac{2y}{2} &= \frac{15}{2} \\ y &= 7.5 \end{aligned}$$

∴ the width is 2.5m and the length is 7.5m

$$A = (2.5)(7.5)$$

$$A = 18.75 m^2$$

#9

a) $d = 0.1t^2 - 3.5t + 6$

$\quad\quad\quad\quad a \quad\quad b \quad\quad c$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{-(-3.5) \pm \sqrt{(-3.5)^2 - 4(0.1)(6)}}{2(0.1)}$$

$$= \frac{3.5 \pm \sqrt{9.85}}{0.2}$$

$x_1 = 33.19 \quad\quad x_2 = 1.807$

Difference between the zeroes

$= 33.19 - 1.807$

$= 33.38$

$\therefore$ Daisy is underwater for 33.38 seconds

b) $d = 0.1t^2 - 3.5t + 6$

$$x = \frac{-b}{2a}$$

$$= \frac{-(-3.5)}{2(0.1)}$$

$= 17.5$

sub $x = 17.5$ into equation

$= 0.1(17.5)^2 - 3.5(17.5) + 6$

$= -24.625$

$\therefore$ Daisy dove 24.625m.

OR

$= 0.1t^2 - 3.5t + 6$

$= 0.1(t^2 - 35t) + 6$

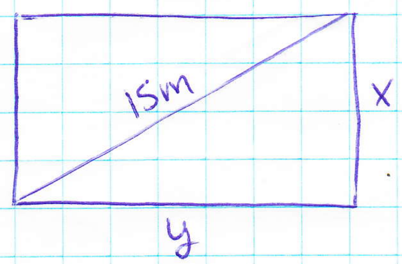
$= 0.1(t^2 - 35t + 306.25 - 306.25) + 6$

$= 0.1[(t - 17.5)^2 - 306.25] + 6$

$= 0.1(t - 17.5)^2 - 30.625 + 6$

$= 0.1(t - 17.5)^2 - 24.625$

#17



① $x^2 + y^2 = 15^2$

② $x + y + 15 = 36$

$x + y = 36 - 15$

$x = 21 - y$ isolate x

sub $x = -y + 21$ into ①

$$(-y+21)^2 + y^2 = 15^2$$

$$(-y+21)(-y+21) + y^2 = 225$$

$$y^2 - 21y - 21y + 441 + y^2 = 225$$

$$\underset{a}{2y^2} \underset{b}{- 42y} \underset{c}{+ 216} = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{-(-42) \pm \sqrt{(-42)^2 - 4(2)(216)}}{2(2)}$$

$$= \frac{42 \pm \sqrt{36}}{4}$$

$x_1 = 9$ $\qquad$ $x_2 = 12$

∴ The dimensions of the field are 9m by 12m